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AN EFFICACY OF MULTI-FUNCTIONAL LIQUID BIOFERTILIZERS ON MANDARIN ORANGES: FIELD EXPERIMENT RESULTS

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ABSTRACT

The present investigation entitled "Studies on liquid biofertilization of soil and its impact on growth, quality and productivity of mandarin oranges was conducted in a well established mandarin orange orchard with 5 years old orange trees planted at 6 x 6 m spacing having uniform growth and productivity at Dhapewada Farm, Maharashtra, India during 2016-2018. The results revealed that, there were significant variations in growth and yield of sweet orange due to application liquid biofertilizer formulation (Acetobacter, Azotobacter Psudeomonas, Trichoderma, Frateuria). Field trials revealed a significant increase in height of the plant (5.5-26%), stem diameter (5.3 - 25.7%), weight of fruit (9.6 - 36.5%) and a number of fruits (7.0 - 29.7%) using formulation T-5 in comparison to T-1 during the year 2016-18.

KEYWORDS: Mandarin Orange & Liquid Biofertilizer

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Original Article

INTRODUCTION

The changing paradigm towards agriculture has necessitated that horticultural sector may be looked as an enterprise for providing the livelihood security to the farmers globally. Diversification in cultivation of horticultural crops will not only ensure sustained income to the farmer, but will also generate the employment in the rural as well as urban sectors. India has a unique climatic advantage that makes it the world's second largest producer of fruits 88819 MT with a productivity of 13.97 tonnes per hectare. Among fruits, citrus is an important crop and occupies an area of about 987,000 ha with production of 12181 thousand tones (Anonymous, 2015). Sweet orange is important fruit crop. India endowed with varied agro climatic condition where wide range of citrus species can be grown on a commercial scale (Shyam Singh et al., 1996). Fertilizer is one of the major inputs in citrus farming contributing about 1/3rd of the cost of cultivation and responsible to maintain soil fertility, crop yield, fruit quality, tolerance to pests, diseases and other stresses (Srivastava and Singh 2003d). However, large scale use of chemical fertilizers causes problems of ground water and environmental pollution through leaching of volatization, respectively. The disproportionate use of fertilizer has widened the soil imbalance in terms of the NPK ratio (Dheware & Waghmare, 2009). It has now been realized that the use of chemical fertilizers must be replaced with more economic, renewable and environmental friendly biofertilizers.

Biofertilizer is a substance containing living microorganisms, which, when applied to seeds, plant

surfaces, or soil, colonises the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plants (Vessey, 2003). However, in spite its promising aspects, biofertilizers lack certain features such as special care for long-term storage, lose their effectiveness if the soil is too hot or dry, highly sensitive to characteristics of soil, that makes them demerits unsuitable for wider applications. Liquid biofertilizer is increasingly available in the market as one of the alternatives to chemical, organic fertilizers and solid substrate-based biofertilizers. Some of the benefits from liquid biofertilizers include a population of microorganisms, longer stability and no need of special carrier. The liquid biofertilizers came into existence since 1998 but till date, very few information was reported demonstrating the efficacy of liquid biofertilizers on plant growth and fruit yield in mandarin oranges. Concerns about improving nitrogen use efficiency, reducing nitrate pollution, contamination due to byproducts of various chemical pesticides in use, and continued gradual loss of SOM have always been the major core issues, and more so, in organic citrus using biofertilizers (Ferguson 1994). But, the promise of liquid biofertilizers in citrus has yet not received the priority, it deserves, with the result, soil physical, chemical, and microbiological health have deteriorated irrecoverably in many commercial citrus belts. Hence this study was carried out to investigate the effect of liquid biofertilizer formulation on parameters of growth and quality, importance such as height of tree, stem diameter of the tree, weight of fruit and a number of fruits.

MATERIALS & METHODS

Present investigation entitled 'Studies on liquid biofertilization of soil and its impact on growth, quality and productivity of mandarin orange' was carried out during the year 2016-18. The soil selected for the experiments was medium, black, alkaline, with available N (150 kg/ha), P (6.4 kg/ha), K (423 kg/ha), organic C (0.38%), and with 58.34% water holding capacity. Thirty uniformly growing trees of age 5 years at different locations were selected and grouped in six and tagged with Treatment Nos. The liquid biofertilizer cultures (*Azotobacter, Psudeomonas, Bacillus, Frateuria Aurantia & Trichoderma*) were used. Liquid biofertilizers solutions were prepared with a ratio of 1: 200 for each treatment with an average of viable cell count of 1 x 10^{14}cfu/ml for (*Azotobacter, Psudeomonas, Bacillus & Frateura Aurantia*) and 1 x 10^{8}cfu/ml for *Trichoderma*. Each tree in a group was inoculated with 5ml of bio-inoculant every 20 days.

T - 1: No Treatment (Control)

T - 2: Azotobacter + Trichoderma

T - 3: Azotobacter + Trichoderma + Psudeomonas

T - 4: Azotobacter + Trichoderma + Psudeomonas + Bacillus

T - 5: Azotobacter + Trichoderma + Psudeomonas + Bacillus + FrateuriaAurantia

Observations were recorded on height of tree, stem diameter and number of fruits picked per plant, yield of fruit. The mean data for the yield was subjected to statistical analysis.

RESULTS & DISCUSSION

Height & Steam Diameter of Tree

Height of the plants was studied from February 2016 to February 2018after inoculation. The plant height for T-1 (control) treatment at February 2016 and 2018 was found to be 198.1 and 396.2 cm respectively whereas T-5 (*Azotobacter + Trichoderma + Psudeomonas + Bacillus + Frateuria Aurantia*) showed 243.8 and 503.4 respectively. The treatment T-5

has shown a maximum increase of 26.8% compared to T-1 (control). The findings are in agreement with Gohil et.al, 2007. The mean stem diameter was under investigation from February 2016 to February 2018. The maximum stem diameter for T-5 at February 2018 was found to be 35.8 cm, whereas the minimum stem diameter was 27.9 cm in control.

The treatments T-1, T-2, T-3, T-4 and T-5 have shown an average increase of 5.5%, 13.8%, 21.3%, 26.8 increased mean stem diameters per plant over the control. A secretion of growth hormones and availability of nutrients and moisture influenced positively the stem diameter.

Weight of Fruit

Average weight of a fresh shoot was observed from February 2016 to February 2018. The maximum average weight of oranges with treatment at February 2018 was found to be 127 grams, whereas the minimum was recorded in the control 93. The treatments T- 2, T-3, T-4 and T-5 have shown 9.67 %, 18.2%, 27.9%, % and 36.5% increase of average weight of a fresh shoot over the control T-1. The liquid biofertilizer treatments recorded significantly more weight due to the proper nutritional supply. These findings are in close agreement with (Jugnake et.al, 2017).

Number of Fruits

The maximum number of fruits picked per plant during the crop time was recorded for treatment T-5 (540 - 2006) for the year 2016-2018, whereas the minimum fruits picked per plant were recorded for control (T-1) (452 - 1476). The treatments T-2, T-3, T-4 and T-5 have shown 7.0%, 12.6%, 19.4%, a 29.7 % increase in fruits picked per plant respectively over the control. All the treatments were significantly superior in fruit yield over the control.

CONCLUSIONS

In the advent of high density planting and increased productivity per unit area and time coupled with heavy use of inorganic inputs, necessitated the adoption of citrus cultivation with liquid bio-inoculant as a viable technology. Such a strategy is very pertinent, keeping in mind the growing awareness for quality citrus production. This is possible only when the nutrient-supplying capacity of the soil withstands the nutrient demand by citrus on a sustained basis. With the availability of more technical know-how on the efficient use of liquid biofertilizers, would claim a strong favour amongst commercial citrus growers, more than ever before, in the years to come. Organic citrus, hence, would no longer be considered a backward practice, but rather a real innovative production technique based on eco-friendly means with ample security for soil fertility and consistency in quality and productivity.

T-5 treatment has shown highest increment in height (26.8%), Steam diameter (25.7%), Weight of fruit (36.5 %) and Number of fruits (29.7) against treatment T-2, T-3 and T-4. Present field results are promising to achieve high quality products consistently.

Table 1: Effect of Liquid Biofertilizer on Different Parameters for Mandarin Orange

Parameters	Observations	T-1	T-2	T-3	T-4	T-5	% Increase (range)
Height (average),cm	2016	198.1	207.2	219.4	237.7	243.8	5.5 - 26.8
	2017	274.3	289.5	313.9	332.2	350.5	
	2018	396.2	420.6	455.9	483.7	507.1	
Average		289.5	305.7	329.7	351.2	367.1	
Stem diameter (average), cm	2016	14.8	14.9	15.3	16.6	17.0	5.3 - 25.7
	2017	19.3	20.5	22.2	23.5	24.8	
	2018	27.9	29.6	32.1	34.1	35.8	

Average		20.6	21.7	23.2	24.7	25.9	
Weight of fruit (average), gm.	2016	90	95	102	107	110	9.6 - 36.5
	2017	94	103	110	115	125	
	2018	97	108	120	135	145	
Average		93	102	110	119	127	
No. of fruits/tree (average)	2016	452	483	499	520	540	7.0 - 29.7
	2017	876	927	965	1001	1095	
	2018	1476	1594	1697	1830	2006	
Average		935	1001	1053	1117	1213	

REFERENCES

1. *Govind Choube, Dr. Vijay Karadbhajne, Dr. Yogesh Johi, Dr. Hemant Jambhekar, Trisha Dhargave (2018), A pilot scale process for the production of high shelf life multi-functional liquid bio-fertilizer, International journal of bio-technology and research, vol-8, Oct 2018.*
2. *Anonymous. 2015. Horticultural Statistics at a Glance 2015. Horticulture Statistics Division Department of Agriculture, Cooperation & Farmers Welfare Ministry of Agriculture & Farmers Welfare Government of India. Oxford University Press. Pp.16.*
3. *Shyam Singh, Ladaniya, M.S., Shirgure, P.S., Das, A.K., Shivankar, V.J., Huchche, A.D., Marathe, R.A. and VinodVinjari(1996). Citrus 1001 question-answers, Soil and Nutrition, pp. 89-90.*
4. *Dheware RM & Waghmare MS (2009), Influence of organic-inorganic and biofertilizers and their interactions on number offruits per tree and average weight of fruit of sweet orange (Citrus sinesis Osbeck L.), International Journal of Agricultural Sciences, Vol. 5 Issue 1, January to May, 2009 : 251-253.*
5. *Choubey, G., Dhargave, T., & Joshi, Y. A Pilot Scale Process For The Production Of High Shelf Life Multi-Functional Liquid Biofertilizers.*
6. *Srivastava AK & Singh S (2003d), Biofertilizers an upcoming alternatives to chemical fertilisers for better soil fertility and citrus nutrition, Indian Fertilizers, (Scene Annual) 16: 42-53.*
7. *Vessey, J. K.(2003). Plant growth promoting rhizobacteria as biofertilizers. Plant Soil, 255, 571-586.*
8. *S. N. Gohil, R.V. Path, U.S.Tiwari, D. D. Jagtap, V. B. Jadhav, S.V. Bulbule and A.M. Musmade (2007), Use of bio-fertilizers to improve yield and quality in sweet orange (Citrus sinuses osbeck) CV mosambi under sub-arid zone of Maharashtra, 13 (1), 119-121.*
9. *Jugnake MO, Dr. MB patil and Dr. Shinde SE (2017), Effect of biofertilizer and chemical fertilizer on growth and yield of sweet orange (Citrus sinensis L. Osbeck), International Journal of Chemical Studies, 5(6): 1061-1064.*